Rocks and Minerals

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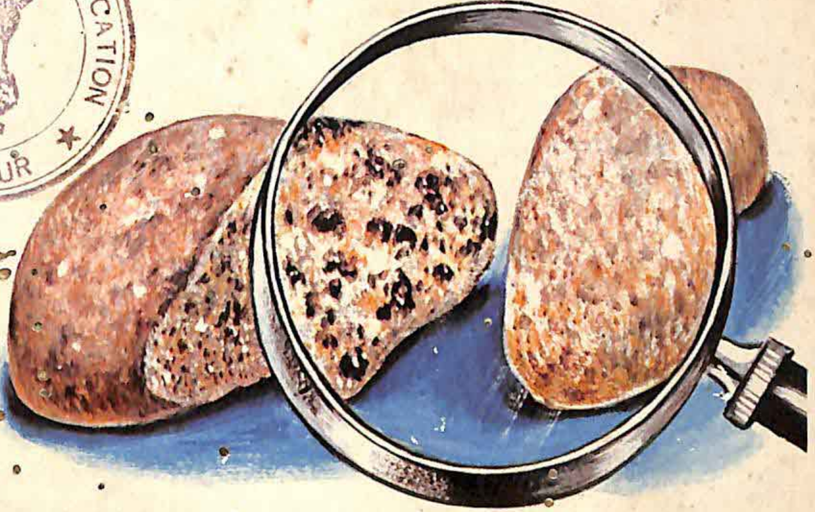

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Rocks and Minerals

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Rocks make up the outer part of the earth. They form the mountains. Everywhere, under the soil and under the oceans, there is solid rock. In many places we can see it sticking out of the soil.

A rock is made up of minerals. Different rocks contain different kinds of minerals.

Minerals are made by nature. They are made out of non-living things.

A few rocks are made up of only one mineral. But most have more than one mineral in them.

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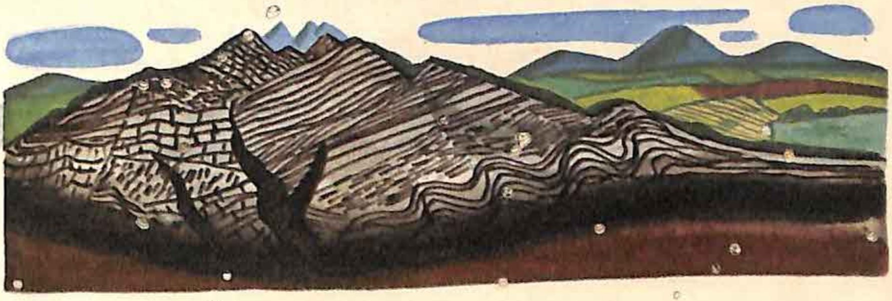
Rocks are interesting to collect and study. They tell the story of what the earth was like long ago. Rocks can tell us how the earth has changed.

All the rocks in the world are divided into three groups. One of the three groups is the group of igneous rocks. The name igneous comes from a word that means fire.

Deep inside the earth it is very hot. In some places it is hot enough to melt rocks.

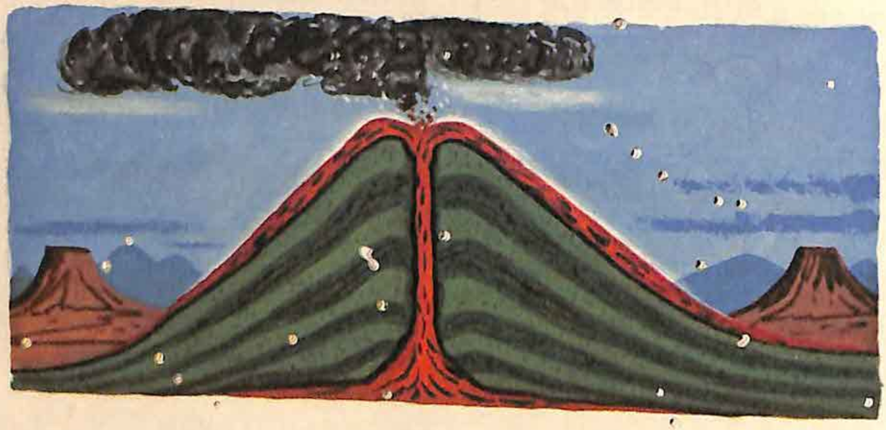
Many times in the history of the earth liquid rocks have been squeezed up nearer the surface of the earth, where it is not nearly so hot.

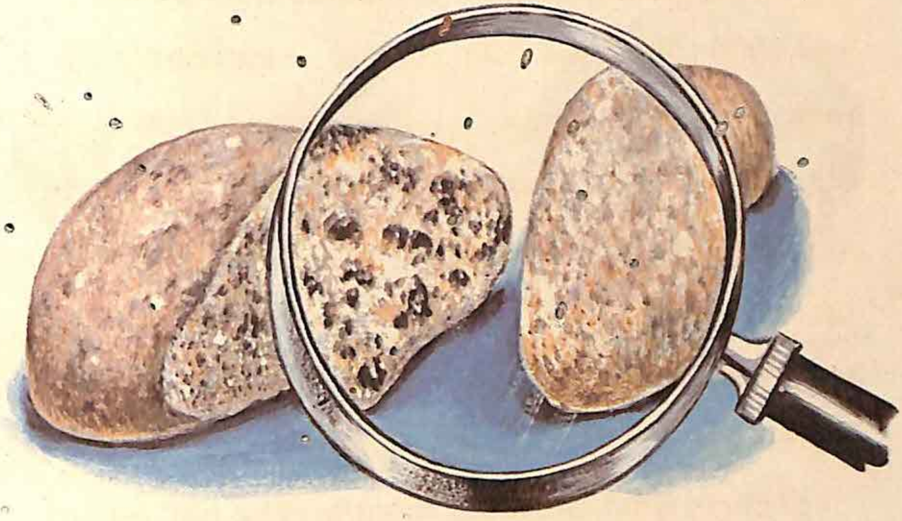


There, after a long time, the liquid hardened into solid rock. This solid rock is an igneous rock. It may be granite, or it may be one of the other kinds of igneous rocks.

Sometimes the hot liquid rock pushes right up to the surface of the earth. It pours out of cracks at the earth's surface and flows out over the ground.

This is what causes a volcano. The boiling igneous rock that pours from volcanoes is called lava. When lava cools, it forms solid igneous rock.





Granite is one of the most common rocks. If you find a speckled pebble, it may be granite.

Ask someone to break some granite with a hammer, then look at the broken parts. Use a magnifying glass. You will see that the pebble is speckled because it is made of three minerals.

The one which looks like glass is quartz. The pink and light grey minerals are feldspar. The black mineral in many granites is mica.

Pieces of granite

But pieces of granite can look very different. First of all, the mineral chunks in them may be tiny, or they may be quite large.

Then, all the feldspar may be light grey. This will make the rock look black and white instead of black and pink.

Granite may have silver-white mica in it, instead of black mica. Or, instead of mica, it may have black, solid-looking bits of a mineral called hornblende.

See how many different kinds of granite you can find. They must have quartz, feldspar, and mica or hornblende in them, or they are not granite. The minerals in granite fit together very tightly. They do not crumble easily in the air and rain.

Many buildings and monuments are made of granite. It is easy to cut and polish.

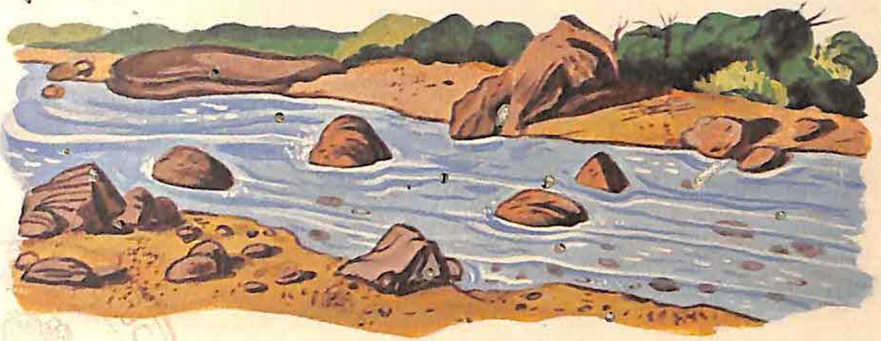
It is a handsome stone, and it lasts for a long time.

Building made of granite.

The second group of rocks is called the sedimentary rocks. They get their name from the word sediment. A sediment is a material that has settled to the bottom from a liquid, or that has been dropped by the wind. Sedimentary rocks are formed from older rocks that were already solid.

The rocks on the surface of the earth are slowly changing. In the air and the rain some of the minerals of an igneous rock change to different ones. The new minerals do not fit together so tightly. The rock begins to crumble.

Water gets into cracks in the rocks, too, and freezes there. This pushes the rocks apart.



The rocks are broken into pieces that water and wind carry away. As they are carried along in a stream, they are worn down even smaller.

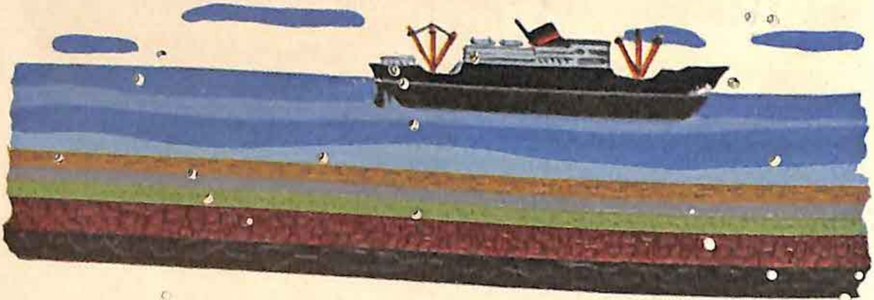
The rivers and streams run down to the sea, carrying the tiny pieces of rock. Some pieces are dropped on the way. Some are carried on until they come to the sea or a lake. By this time, most of the quartz pieces are grains of sand. The feldspar and mica pieces become mud.

Rivers and streams keep on carrying more mud and sand, and dropping them. After a long time layers of these broken rock materials, or sediments, are built up on top of each other.

Many small animals with shells live in the sea. Their shells are made of a mineral called lime. When the small animals die, their shells fall to the bottom of the sea. There, many of them are broken up by the moving water. Broken and whole shells mix with the sand and mud. In some places shells may cover the whole sea bed.

When all this has gone on for a long time, layers of sand, layers of mud, and layers of lime are formed. These layers are always being covered by new layers.

After a long time, a great thickness of new layers of sediment lies on top. The weight of these upper layers pushes down on the sand and mud and lime. It packs them together into rock.



Layers of sedimentary rock at bottom of the sea.

But there are still spaces between the grains of sand. Under the surface of the earth, water fills these spaces. The water carries minerals from other rocks. It may carry lime or quartz or iron minerals.

These minerals fill all the spaces between the grains of sand. They cement the grains of sand into really solid rock.

In this way, after a long time, the layers of sand become layers of sandstone.

They may be white, grey, yellow, brown or red. The colour depends on the kind of minerals between their grains.

Sandstone

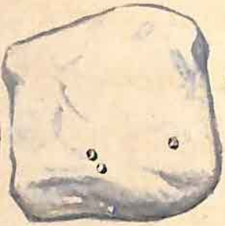
Shell limestone

The mud layers become shale. Shale is usually grey, but it may be black, or green, or red. Its colour depends on the colour of the mud from which it was made. Shale is in thin layers. When it is wet, it smells like mud.

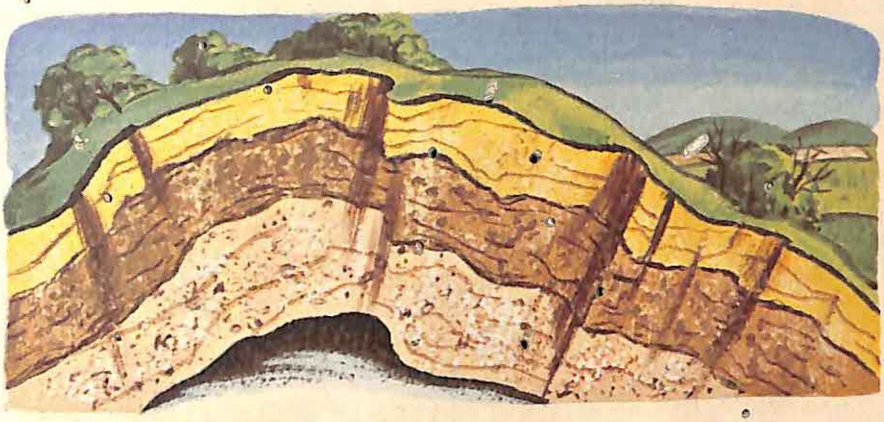
The rock made from lime or broken-up shells is called limestone. Limestone is white, cream-coloured, grey or tan. It is a very good building stone. It can be cut easily by machines, and it is strong.

Sandstone is sometimes used as a building stone. Shale is too soft, and breaks too easily, to be used as a building stone.

Sandstone


Limestone

Shale



Layers of rock pushed up to make mountains.

Layers of sandstone, limestone, and shale, formed in the sea, may be pushed up very slowly to make mountains.

In some places, high on the dry land, we can see layers of sandstone, shale or limestone. Many of them were formed in a sea which covered these places long ago.

In many of these rocks, fossils of sea animals can be found. Fossils are traces of animals or plants that lived long ago, when these rocks were being formed.

Fossils in rocks.

If we look closely at a piece of limestone, we may see little bits of fossils, or even whole ones. We may see little shells.

In sandstone and shale beds from swamps of long ago we can find prints of the leaves and trunks of the trees that grew then.

In other rocks we may find tracks of the reptiles called dinosaurs, or their bones.

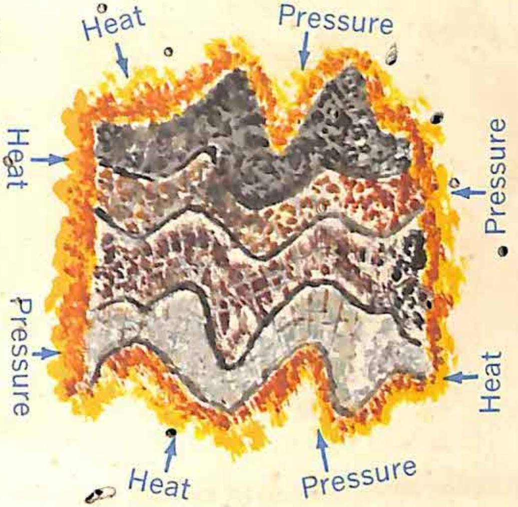
By studying fossils, we can learn about the history of life on earth. We can learn about the different animals that lived in the past.

Granite

Sandstone

Shale

Limestone



Gneiss

Quartzite

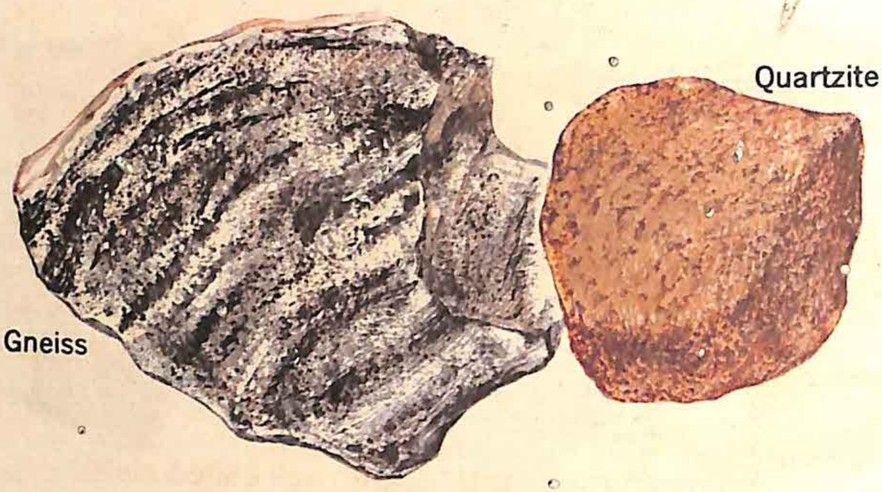
Slate

Marble

Metamorphic rocks are the third great group of rocks. Metamorphic means changed in form.

All metamorphic rocks were once igneous or sedimentary rocks. Great heat and pressure deep inside the earth changed them to metamorphic rocks.

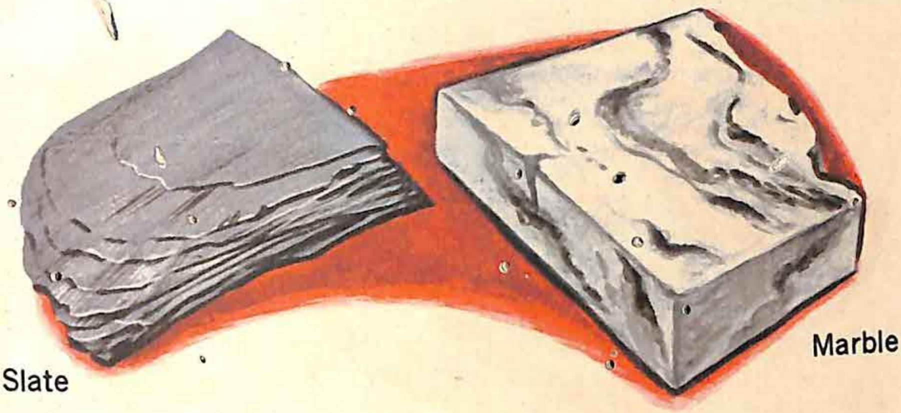
Each kind of igneous and sedimentary rock changes into its own kind of metamorphic rock.



Granite may turn into a rock called gneiss. The feldspar and quartz are squeezed together into layers. The mica forms separate layers between the layers of feldspar and quartz.

Gneiss is a striped or streaked rock. It is in black and white bands if it was made from black and white speckled granite.

Sandstone is changed to quartzite. This rock has grains of quartz that fit together very tightly. There are no spaces between the sand grains.



Shale changes into a new rock called slate. Most of the mud of the shale turns into mica. The mica flakes fit tightly together, and make the rock harder than shale. They make it more shiny, too. They cause it to break into a new set of very thin layers, which cross the old shale layers. You can see them both in a piece of slate.

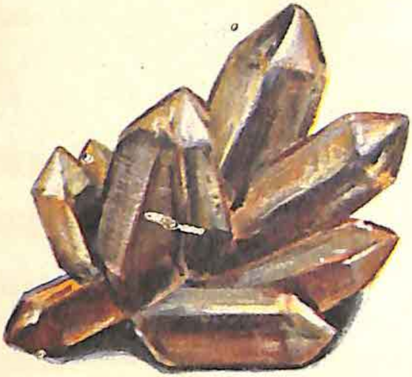
Pieces of slate are used to make roofs. Slate is sometimes used for blackboards.

Marble is the metamorphic rock that is made from limestone. It is used for statues, and for the inside walls of many public buildings.

Pink quartz pebble

Yellow quartz pebble

Grey quartz pebble



Smoky quartz crystals

Many, many different minerals have been found. But only about twenty are common.

Quartz is the most common mineral. If you find a pebble that is hard and smooth, it may be a quartz pebble.

Quartz pebbles can be milky-white, grey, yellowish, or pink.

Amethyst

Blue quartz

Flint arrowhead

Pure quartz is clear, like glass or ice. In some places it is found in beautiful crystals with six sides.

Purple quartz is called amethyst. It is used in rings and necklaces. Flint is a smooth kind of quartz that is opaque. Opaque means that it does not let light through. Flint is very hard.

Our ancestors used flint for arrowheads. It chips easily, and the chipped pieces have sharp edges. It is hard, too. Broken pieces of every kind of quartz are never really flat. The faces are slightly curved.

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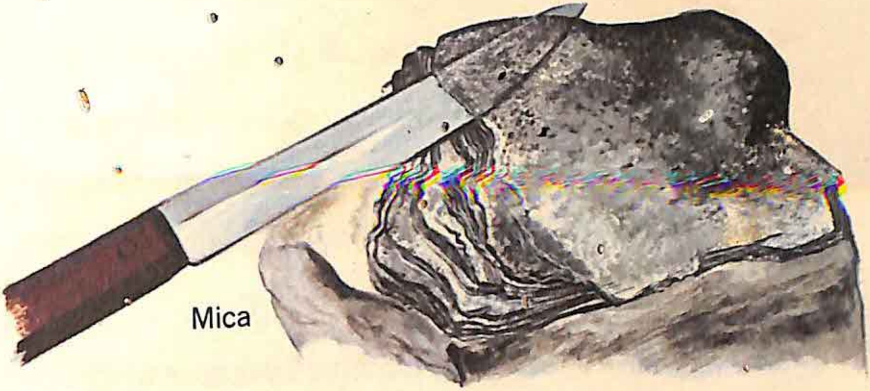
Feldspar

Another very common mineral is feldspar. Feldspar is dull, not glassy-looking like quartz. It is opaque, so no light comes through it.

It is hard to know if you have found a feldspar pebble unless you hit it with a hammer. Then the dull pebble will break into shiny chunks, with flat sides. These surfaces will gleam if you turn the feldspar in a strong light.

The edge of a piece of quartz will scratch a piece of feldspar. Feldspar is usually light grey, or creamy-white. Some kinds are pink or apple-green.



Mica is another common mineral. But you will not find it as a pebble. You will have to go to a quarry or a museum to see big pieces of mica.

The big mica crystals are called "books" of mica. This is because sheets of mica as thin as paper can be peeled from them. You can see through the thin sheets.

These sheets can be partly peeled off, too. Then the whole crystal looks like a book that someone is holding open by both covers.

Mica may be black, silver-white, yellowish or mauve.

You can scratch mica with an edge of glass. You can even scratch it with your fingernail.

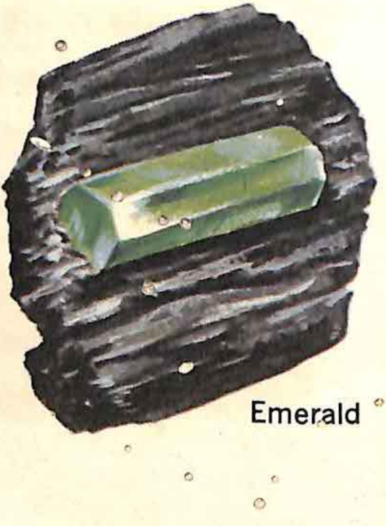
But you can bend a sheet of it without breaking it, if you are careful.

Mica will not burn. So tiny flakes of white mica are safe to use as Christmas tree snow, or as a snowstorm in films and at the theatre.

The earth is full of treasures: gems like diamonds, amethysts and rubies.

Diamond

Amethyst

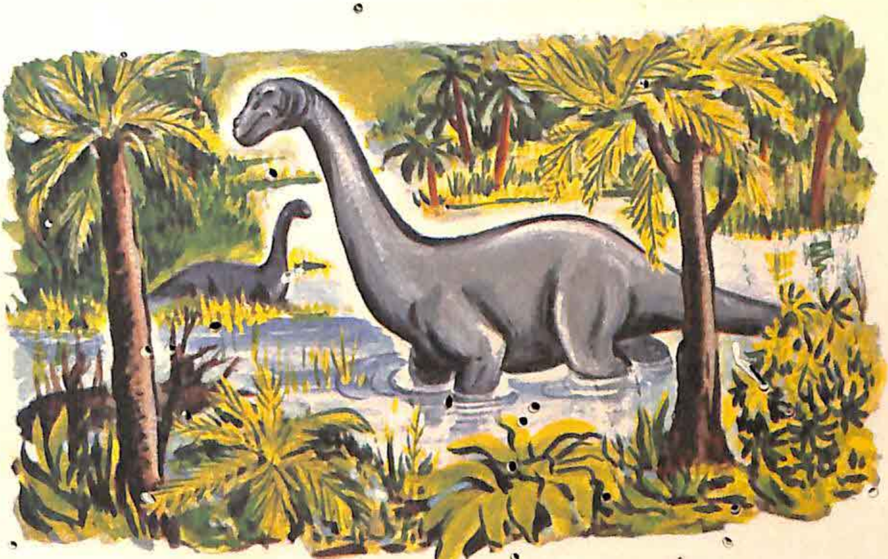


Emerald

It is full of useful minerals and rocks, too. Men work in quarries and mines digging them out of the earth.

One of the most useful rocks is coal. It is a sedimentary rock that was formed in a different way from limestone or sandstone.

Coal was made from forests that grew in the swamps of long ago, even before the time of the great dinosaurs. As the trees died, they fell into the water and were covered by mud.



Soft coal

Hard coal

Graphite

Little by little, they were changed to soft coal. In sandstone or shale layers between these coal beds, fossils of leaves may be found.

Under great heat and pressure, soft coal is changed into hard coal. Hard coal is a metamorphic rock. It is much harder and cleaner than soft coal. Soft coal and hard coal contain carbon. Hard coal has more pure carbon than soft coal. The mineral called graphite is pure carbon.

Deep under the ground, water slowly moves through the rocks, filling cracks and spaces. Water carries different minerals and metals. In some cracks it leaves quartz, in beautiful crystals. Gold is sometimes found in this quartz.

Most metals are not found pure, as gold is. They are joined with other materials to form minerals. These minerals may be part of a rock, or they may fill cracks in the rocks, forming bands or layers.

Rocks or minerals like these are called ores. Metals can be separated from ores in factories, without too much work.

Some copper ores are in beautiful colours of blue and green.

Most iron ores are red. Iron ores are minerals that have a great deal of iron in them. At steel mills the ores are heated in hot furnaces to get the iron from them.

Copper

Gold in quartz

Iron ore

Uraninite

Pitchblende

A very valuable mineral is pitchblende, from which we get the metal uranium.

Uranium changes very slowly to lead. It is one of the few metals that change naturally to other metals. As it changes, uranium gives out a large amount of energy or power. Uranium is a material from which we get atomic energy. Atomic energy is very important in the world today.

Studying rocks and minerals is a good way to learn about our earth.

Great masses of granite tell us of hot liquid rock moving up in the past. They are on the surface now, instead of deep in the earth. So we know that this part of the earth has been lifted up, and the material once on top of the granite worn away.

Layers of limestone, shale, and sandstone in the Grand Canyon of the Colorado

Layers of sandstone, shale, and limestone, which contain fossils of sea animals, show where a sea has been long ago. Now the place may be dry land.

As we learn more and more about these materials, they tell us the history of the earth.

Things you can do

Look for rocks for a collection. Rock collecting is fun, and anyone can do it. The common rocks can be found everywhere, because they are the material of which the earth is built. You can find them in the lanes, in a gravel drive, and when you are digging in the garden. All kinds of pebbles can be found on the beach, rocks of all sizes, shapes and kinds in fields and in the country.

One of the best places to look for rocks is where man has dug up the earth. You will find many kinds of rocks in newly-made roadbeds, in rock quarries, in dump piles near mines, and along railway lines. Be sure to have an older person with you when you visit these places.

If your family goes on a holiday where there are mountains, you will find plenty of rocks on the bare mountainsides. In many parts of Britain, it is easy to make a beautiful and varied collection of rocks and minerals.

When you look for rocks, take a strong paper bag to hold the ones you find. Take pencil and paper so that you can write down the exact place where you found each rock.

It is best to start your collection with small rocks. You may want to bring a hammer to break pieces off big rocks, or to break open pebbles you find. But when you use a hammer, be sure to wear sunglasses to protect your eyes from flying rock chips. Always wrap the rock in a piece of cloth before you hammer it.

Identify the rocks. Bring your rocks home and try to find out what they are. A rock book with pictures of all the rocks will help you. The rock book will also tell you all about the rocks and about what tests you can make.

Each mineral comes in certain colours only. Some have crystal shapes that belong to them only. Some are always dull-coloured. Others are bright and shiny. A magnifying glass will help you to see the minerals in the rock more easily.

You can tell some minerals by the colour they make when you rub them on the back of a porcelain tile. Sometimes the colour they make on the back of the tile is the same as the colour of the mineral. Sometimes the colour made on the tile is different from the colour of the mineral.

Some minerals are harder than others. Some you can scratch with your fingernail. Some can be scratched by a knife or piece of glass. Others are much harder and will scratch glass. You can get a little square of glass from an ironmonger's to test minerals for hardness.

Some of the rocks you collect will most likely be limestone. There is a special test for limestone. When you put a few drops of acid on limestone, it will bubble and fizz. Try putting a few drops of concentrated lemon juice on your rocks. Those that bubble and fizz are limestone. Hydrochloric acid works best for this test. Ask a grown-up to do this test for you. Do not use the hydrochloric acid yourself. It can burn your skin.

Store your collection. When you have found out what the rocks are, you will want to store your collection. Cigar boxes and cardboard boxes are good for storing rocks. Egg cartons are good for storing smaller rocks.

Cut small squares of white adhesive tape and stick a piece on each of the rocks you have collected. Write a different number on each square. In a notebook write down the number you have given the rock, the place where you found it, and the date. If you found out what kind of rock or mineral it is, put this down too. If not, leave an empty space. When you do find out, you can write it in.

Natural history museums and scientific suppliers all have rock collections. But it is more fun to collect them yourself.

Make your own mineral crystals. Ask your mother to get you some powdered alum at the chemist's. Ask her to heat some water until it boils, then put the water into a cup. Add a large spoonful of powdered alum to the hot water and stir with a spoon until the alum dissolves. Keep adding more alum, stirring all the time, until no more will dissolve. Now wrap one end of a piece of string round a small stone and lower the stone into the water. Let the other end of the string hang over the side of the cup. Let the water cool slowly. After an hour, take the string out of the water. Beautiful crystals of alum will have formed on the string. Look at the crystals with a magnifying glass.

Words younger children may need help with

(Numbers refer to page on which the word first appears)

4 solid
minerals
nature
5 divided
igneous
history
liquid
squeezed
surface
6 granite
volcano
lava
7 speckled
magnifying
quartz
feldspar
mica
8 hornblende
9 crumble
monuments
polish
10 sedimentary
material
freeze
13 cement
sandstone
14 shale
limestone
machines
15 fossils
16 swamps
reptiles
dinosaurs
17 metamorphic
pressure
18 gneiss
striped
streaked
quartzite
19 blackboards
marble
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public
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23 quarry
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27 ores
separated
factories
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28 pitchblende
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